

THE ANALYST.

FEBRUARY, 1902.

PROCEEDINGS OF THE SOCIETY OF PUBLIC ANALYSTS.

THE annual general meeting of the Society was held on Wednesday evening, January 22, 1902, in the Chemical Society's Rooms, Burlington House. The President (Dr. J. AUGUSTUS VOELCKER) occupied the chair.

The President having read the notice convening the meeting, the minutes of the previous annual general meeting, held on February 5, 1901, were read and confirmed.

Messrs. B. Kitto and D. Lloyd Howard were appointed scrutators of the ballot-papers for the election of Officers and Council for 1902.

The Hon. Treasurer (Mr. E. W. Voelcker) presented his annual report for 1901.

Dr. RIDEAL moved that the Hon. Treasurer's report should be adopted, and that a vote of thanks should be accorded to the Hon. Treasurer for his services during the past year.

The motion was seconded by Dr. SCHIDROWITZ, and carried unanimously.

The HON. TREASURER, having responded, proposed a vote of thanks to the auditors (Messrs. L. Kidgell Boseley and Martin Priest), which was seconded by Mr. John White, and unanimously passed.

Mr. HEHNER proposed a vote of thanks to the President and Council of the Chemical Society for their kindness in having continued to allow the Society of Public Analysts to use their rooms at Burlington House for meeting purposes during the past year. Dr. DYER seconded the proposition, which was carried unanimously.

The President then delivered his annual address.

Dr. DYER proposed a vote of thanks to the President for his address, coupled with a request that he would allow the address to be printed in the Society's Proceedings. The proposition was seconded by Mr. H. DROOP RICHMOND, and was carried unanimously.

The President having responded, a vote of thanks to the Hon. Secretaries for their services during the past year was proposed by Mr. JENKINS, seconded by Mr. KITTO, and carried unanimously.

Mr. BEVAN (Hon. Secretary) having acknowledged the vote of thanks,

The PRESIDENT announced that the scrutators had reported that the Officers and Council for 1902 had been duly elected, in accordance with the nominations made by the Council in December, 1901.

Mr. BEVAN then read the following list of Officers and Council elected for 1902 :

President.—J. Augustus Voelcker, M.A., B.Sc., Ph.D.

Past-Presidents.—M. A. Adams, F.R.C.S., Alfred H. Allen, Sir Charles A. Cameron, C.B., M.D., F.R.C.S., A. Dupré, Ph.D., F.R.S., Bernard Dyer, D.Sc., W. W. Fisher, M.A., Otto Hehner, Alfred Hill, M.D., J. Muter, Ph.D., Thos. Stevenson, M.D., F.R.C.P.

Vice-Presidents.—Wm. Chattaway, Henry Löffmann, M.A., M.D., Francis Sutton.

Hon. Treasurer.—E. W. Voelcker, A.R.S.M.

Hon. Secretaries.—Edward J. Bevan, Alfred C. Chapman.

Other Members of Council.—Julian L. Baker, Bertram Blount, Lawrence Briant, W. J. Dibdin, Arthur E. Ekins, Thomas Fairley, R. H. Harland, James Hendrick, B.Sc., Julius Lewkowitsch, M.A., Ph.D., W. F. Lowe, Clarence A. Seyler, B.Sc., W. Collingwood Williams, B.Sc.

The proceedings then terminated.

The monthly meeting of the Society was held in the Chemical Society's Rooms on Wednesday evening, January 22, immediately following the annual general meeting. The President (Dr. J. Augustus Voelcker) occupied the chair.

The minutes of the previous monthly meeting were read and confirmed.

A certificate of proposal for election to membership in favour of Dr. L. T. Thorne, F.I.C., was read for the second time; and a certificate in favour of Dr. J. J. L. van Rijn, Consulting and Analytical Chemist, Director of the Royal Agricultural Experimental Station, Maastricht, Holland, was read for the first time.

Messrs. Horatio Ballantyne, M. Hunter, M.A., E. A. Lewis, Frederick J. Lloyd, Albert E. Parkes, and Thomas Tickle, B.Sc., were elected members of the Society.

The following papers were read: "Note on Reichard's 'Silver' Method for the Determination of Morphine in Opium," by Philip Schidrowitz, Ph.D.; "Note on a Sample of Coffee containing Starch," by Cecil H. Cribb, B.Sc.; "Note on a Sample of Artificial Coffee Beans," by Cecil H. Cribb, B.Sc.; and a "Note on Spurious Cream of Tartar," by John White.

THE MANNITIC FERMENTATION OF WINE.

By PHILIP SCHIDROWITZ, PH.D.

(Read at the Meeting, December 11, 1901.)

GAYON and Dubourg (*Ann. de l'Inst. Pasteur*, xv., 527-569) have recently published a paper on the "Mannitol Ferment," describing the properties of this micro-organism, and more particularly the changes produced by it in various sugars and allied compounds.* The paper alluded to records the continuation of the work published

* The final paragraph of an abstract of Gayon and Dubourg's paper which appeared in the *Chem. Centralblatt*, 1901, ii. [10], 648, reads as follows: "It is apparent from the description given of the mannitol ferment that it cannot be the cause of 'sicknesses' in wines." I give the translation (which is a perfectly accurate one) from the German as it appears in the *Journal of the Society of Chemical Industry*, 1901, p. 1010. I was so surprised at this statement that I consulted the original (French) paper, and found that what the authors actually say is: "The results which we have obtained in our work have confirmed our previous studies, inasmuch as they tend to prove that the mannitic ferment is distinct from the 'ferment de la tourne' and the bitterness causing ferment, and that the changes produced

by the same authors in 1894 (*loc. cit.*, viii., 109). In view of the renewed interest which has been aroused in regard to this subject, and also of the fact that the published analytical data in connection with the sickness caused in wines by the mannitol micro-organism is by no means of an exhaustive nature, I believe that it may be of interest to the Society to give a brief account of my experience in this direction, more especially as I have been able to make some observations which have not previously been noticed.

The mannitic sickness of wine was practically unknown, or, rather, unrecognised, until 1899, although it is probable that, under favourable conditions, it has occurred since the days when wine was first manufactured. The mannitic disease was first noticed in Algerian wines; in the first instance in fig, and later in grape wines. P. Carles (*Compt. Rend.*, 1891, cxii., 811) believed that the presence of mannitol in Algerian grape-wines was due to their having been adulterated with fig-wine, which latter usually contains a considerable quantity (0.6 to 0.8 per cent.) of this substance; but subsequent investigations by Jégou (*Journ. Pharm. Chim.* [5], 1893, xxviii., 103) and Lebanneur (*Répert. Pharm.*, 1893, xlix., 10) and others proved that it undoubtedly occurred in genuine Algerian wines. Very shortly afterwards (1892) the fact that the mannitic disease may also, under certain conditions, attack French wines, was demonstrated in a forcible and unpleasant manner.

The mannitic fermentation of wine is caused by a distinctive bacillus. For a description of this organism, its habits and properties, reference must be made to the researches of Gayon and Dubourg (*loc. cit.*), but it may be said here that Roos (*Journ. de Pharm. et de Chim.*, xxvii., 405) apparently first noticed that the conversion of saccharine matter into mannitol could be brought about by micro-organisms found in mannitic wines. Gayon and Dubourg (1894, *loc. cit.*) subsequently isolated the specific mannitol bacterium, which, morphologically, forms very short rodlets, showing a pronounced tendency to grow together in small packets. They also described the morphological and other differences between this ferment and those causing other wine-sicknesses (bitterness, "tourne," etc.). In their latest paper the chemists named have proved that of all the sugars and allied substances (pentoses, alcohols) *lævulose* alone is capable of being converted into mannitol. This conversion is accompanied by the formation of glycerin, fixed and volatile acids (chiefly lactic and acetic acids), and carbonic acid, but no ethylic alcohol is produced. Glucose and other sugars are converted into alcohol, acids, glycerin, etc., the proportion of fixed and volatile acids, however, being considerably higher than is the case in normal alcoholic fermentations. The *Bacillus gummosus* of Happ (*Dissert.*, Basle, 1893), which produces "slimy" fermentations, and, *inter alia*, mannitol, appears to be distinct from the micro-organism of Gayon and Dubourg, and this applies also to the bacteria described by Laborde (*Ann. de la Brass.*, 1898, 337).

In wine the disease develops during the primary fermentation, and the conditions favourable, or, rather, necessary, for its appearance, are a high temperature

by it in wines are different from those produced by the two other sicknesses" (the italics are mine). It appears to be desirable to call attention to this error in translation somewhat prominently, as it might be the cause of considerable misapprehension, and might possibly have serious results.

and a lack of acidity in the grapes. The optimum temperature for the formation of mannitol from lævulose (Gayon and Dubourg, 1901, *loc. cit.*) is 35° C., and this figure is in accordance with practical experience, which has shown that if the temperature of the fermenting vessels is kept under 35° to 37° there is little danger of mannitic infection. The practical results of mannitic fermentation in wine are that a part of the lævulose of the must becomes converted into mannitol instead of into ethylic alcohol, and this is accompanied with the formation of an excessive amount of acids (principally lactic and acetic). The wine acquires an unpleasant sour-sweet taste, remains persistently turbid, and, if the malady acquires a firm hold and is not checked in good time, it is rendered quite unsaleable.

The quantity of mannitol that will form naturally in a solution of lævulose under favourable conditions is (according to Gayon and Dubourg), roughly, 70 grammes per litre. If the acid produced be neutralized with chalk, as much as 200 grammes per litre may be obtained. In wine the maximum observed is about 30 grammes per litre. Gayon and Dubourg (394, *loc. cit.*) describe an Algerian wine with 31.46 and a Spanish wine with 23.50 grammes per litre, but the highest figure for a French wine (red) that I have been able to find is 12.36 grammes per litre. The figure relating to wine No. 2 (see table)—namely, 10.26 grammes per litre—is, to the best of my knowledge, the next highest on record for a claret. Mannitol, if present in moderate quantities, is of itself not harmful from a commercial point of view.* It becomes a danger, however, if it is associated with any considerable quantity of unfermented sugar, with an excess of volatile acid and a large number of bacteria. Thus wines Nos. 6 to 8 all contained a fair amount of mannitol, but very little sugar or volatile acid; they obviously had been sick, but recovered, and at the time of analysis were quite sound. On the other hand, Nos. 3 to 5 contained little mannitol, but the high sugar and volatile acid in these samples were danger-signals which were corroborated by the microscopical examination and general physical condition of the wines. The chief danger (that is, in wines which are not already hopeless, such as 1 and 2) is the presence of unfermented sugar, as this will probably lead to a continuation of mannitic fermentation, together with its attendant evils. It is, however, not certain that the mischief will stop when the whole of the sugar has fermented, for Péglion (*Centralblatt f. Bakter.* [2], iv., 73) states that under certain conditions the mannitic bacteria will convert alcohol into acetic acid; but this certainly requires further confirmation. In any case it is advisable to make a microscopical examination of all suspected samples, and this

* It has hitherto been universally held that the mannitol found in wine undergoes no further change, and remains present as such; but in this connection it may be well to remember that a number of organisms are known which produce either a modified alcoholic fermentation in mannitol, convert it into mannose, or reconvert it into lævulose. It seems conceivable that such organisms *might* be present in a mannitic wine, and produce ulterior changes in the same. The organisms that may be mentioned in this connection are: (a) *B. ethaceticus* and *B. ethaceto-succinicus* (Frankland, *Ann. de l'Inst. Pasteur*, 1892, 653; Frankland and Frew, *Journ. Chem. Soc.*, 1892, 254, and Frankland and Lumsden, *loc. cit.*, 432). The latter converts mannitol into alcohol, formic acid, acetic acid, and succinic acid, and the former has much the same action except that no succinic acid is produced by it; (b) *B. xylinum*, which (*Deutsche Essig Industrie*, 1899), according to Hager, converts mannitol into lævulose; (c) Bertram's sorbitose bacillus, which has the same action as *B. xylinum* (Vincent and Delachanal, *Compt. Rend.*, cxxv., 716); and (d) a micro-organism described by Péré (*Ann. de l'Inst. Pasteur*, 1898, xii., 63), which under certain conditions converts mannitol into mannose.

	No.	Vintage.	Date of Analy- sis.	Alcohol.	Total Acid (as H_2SO_4).	Volatile Acid (as CH_3COOH).	Extract.	Reduced Extract.	Ash.	Cream of Tartar.	Sugar.	Glycer- in.	Specific Gravity.	Mann- itol.
<i>Group A.</i> —Wines com- pletely spoilt ...	1	1895	1896	84.3	5.70	0.33	40.89	38.66	3.55	—	3.23	6.30	1.0014	6.22
	2	1895	1896	85.0	6.47	0.43	43.59	42.01	3.33	—	2.58	6.59	1.0027	10.26
[<i>Group A'</i>].—Wines of same growths as above, but of normal (non-mannitic) vint- ages ...	[1']	1896	1897	82.8	3.49	—	24.64	24.28	2.66	1.66	1.35	7.42	0.9958	—
	[2']	1900	1901	93.1	3.19	—	28.64	27.37	2.72	1.52	2.27	8.23	0.9960	—
<i>Group B.</i> —Wines ren- dered inferior and dangerous. Query whether saleable ...	3	1899	1900	87.3	4.07	1.70	34.60	25.88	2.60	2.14	6.72	7.80	0.9993	1.15
	4	1899	1900	92.0	3.75	1.26	29.85	26.72	2.36	2.01	4.13	8.15	0.9964	1.89
	5	1899	1900	91.3	3.88	1.43	31.18	23.39	2.25	2.34	5.79	6.81	0.9972	1.54
[<i>Group B'</i>].—Wines of same growths as B, but of normal (non- mannitic) vintages...	[3']	1897	1898	86.3	3.44	—	28.77	27.98	2.79	1.06	2.79	7.56	0.9969	—
	[4']	1900	1901	106.8	3.36	—	29.17	26.05	2.21	1.44	4.12	7.98	0.9950	—
<i>Group C.</i> —Wines con- taining a consider- able quantity of mannitol. Had been sick, but recovered, and were sound when analysed ...	6	1895	1896	87.9	4.06	0.23	25.95	25.60	2.74	—	1.34	—	0.9971	2.59
	7	1895	1896	85.7	3.50	0.14	22.06	21.94	2.37	—	1.11	—	0.9945	3.52
	8	1895	1896	103.1	3.89	—	30.79	30.70	3.03	—	1.09	—	0.9959	1.57
<i>Group D.</i> —Old wines of exceptionally fine vintages containing mannitol ...	9	1865	1896	90.7	4.17	—	26.82	26.72	2.18	2.38	1.11	7.99	0.9957	0.66
	10	1875	1896	89.3	4.19	—	25.33	—	2.58	—	nil?	5.16	0.9955	0.50

Note.—Results are expressed in grammes per litre.

as a rule furnishes sufficient indication as to the likelihood of any further bacterial mischief.

In view of the researches of Gayon and Dubourg (*loc. cit.*), of Carles (*loc. cit.*, and *Feuille Viniale de la Gironde*, 1895, and 1896, x., 12), of Jégou, of Lebanneur (*loc. cit.*), of Roos (*Journ. de Pharm. et de Chim.* [5], xxvii., 405, and *Mémoires de la Soc. Phys. et Natur. de Bordeaux*, July 28, 1892, iv., 3), there is little doubt that under ordinary circumstances the mannitic fermentation of wine produces not only a very high total acidity, but also an excess of volatile acid, the latter forming, roughly, one-third to one-half of the whole. That there are exceptions to this rule, however, is evidenced by the figures relating to wines Nos. 1 and 2, in which, although the total acid is high, the volatile acid is not above the normal. I have not been able to find any other cases of this kind recorded in the literature on the subject. On the other hand, in Nos. 3 to 5 the figures for the total acid are not particularly high, and the volatile acid in each case is excessive.

Analytical Methods.—The best *qualitative* test for mannitol in wine is undoubtedly that recommended by Gayon and Dubourg (*loc. cit.*), which consists in allowing a few c.c. of the wine to evaporate on a watch-glass at a low temperature, and, after a time (twenty-four hours as a rule suffice), examining the residue under the microscope. If mannitol is present (1 gramme per litre and upwards) extremely characteristic fine silky needles will be observed. It is best, however, to decolorize the wine first by means of basic lead acetate solution, or, better still, by shaking with a little powdered yellow oxide of mercury. *Quantitative* methods have been devised by Jégou (*Journ. Pharm. Chim.* [5], 1893, xxviii., 103), by Carles (*Compt. Rend.*, 1891, cxii., 811), and by Gayon and Dubourg (*loc. cit.*). Of these the first is, in my opinion, rather too complicated, and the second not very accurate. Gayon and Dubourg's process is fairly simple, gives good results, and, as far as my experience goes, is certainly preferable to the others. In my laboratory it is carried out as follows: 50 c.c. of the wine are evaporated on the water-bath to a syrup (adding 2-3 grammes of sand), and then allowed to stand for two or three days in a cool place. At the end of this time the mannitol will have crystallized out. One hundred c.c. of 85 per cent. alcohol, saturated at the room temperature with mannitol, are then gradually added, stirring vigorously meanwhile, and the whole mass then transferred to a filter, on which it is allowed to drain for two hours. Thereupon the filter is extracted in a soxhlet for one hour with 100 c.c. of 85 per cent. alcohol, four-fifths of the alcohol are distilled off, a little animal charcoal is added to decolorize, the whole is filtered, and then washed twice with about 50 c.c. of hot 85 per cent. alcohol. The filtrate is evaporated at 60°, and the residue, which is practically pure mannitol, weighed as such. If any considerable quantity of sugar is present in the wine it is best to ferment this out before estimating the mannitol. From a fairly large number of mannitic wines examined by the author, the analyses referring to some characteristic samples have been selected, and are given in the table. They are arranged into four groups—A, B, C, D—and for the sake of comparison analyses of wines from the same chateaux, but of normal vintage, are added to groups A and B. The headings to the table sufficiently explain the nature of the wines, but I may add that they were all clarets, and, with the exception of Nos. 6 to 8, of well-known growths.

Nos. 6 to 8 were also wines from the Gironde, but of unknown growth. Nos. 9 and 10 represent two wines which must be classed amongst the finest clarets of the last fifty years.

With regard to Group A, I have already alluded to the remarkable lack of volatile acid, and the comparatively low sugar, but, in addition, I may draw attention to the specific gravity, which is above 1.000—a most unusual thing, but readily explained by the extremely high extract which, in its turn, is of course due to the large proportion of mannitol. These wines were analysed some ten or eleven months after the vintage, and were then in a hopeless condition. It seems likely that if they had been examined immediately after the main fermentation they might have been saved. With regard to the wines in Group B, they were undoubtedly mannitic, notwithstanding the very moderate percentage of mannitol. The figures appear to lend point to the question raised above (see note, p. 44) concerning the possibility of a transformation of mannitol into ulterior products. These wines might have been safeguarded against any further formation of mannitol by pasteurization, but, in view of the high sugar and volatile acid, it is doubtful whether, at the best, they would be saleable or capable of standing bottling. The wines in Group C, although containing from 1.5 to 3.5 grammes per litre of mannitol, were quite sound, and it is evident that they had been attacked by the mannitol bacteria, but, either as a result of careful handling (cooling during fermentation, pasteurizing, and so on), or some fortuitous circumstance, such as a fall of temperature, or a particularly vigorous yeast, they had recovered.

To guard against the danger of mannitic fermentation, the use of overripe grapes—which lack acid—should be avoided when possible, but if this is inexpedient it may be practicable to raise the acidity of the must by judicious blending, or by an addition of 1 to 3 grammes of tartaric acid per litre of must, which is, in my opinion, both legitimate and likely to have the desired effect. Further, appliances for attenuating the *cuvée* during hot seasons should be at hand whenever there is an adequate water-supply, and if the expense is not beyond the means of the proprietor. Unfortunately these conditions are not always attainable. If the wine is not quite hopeless after the main fermentation is well over, immediate pasteurization will prove an efficient safeguard in most cases, but the operation must (when the wine is very young) be accompanied by a subsequent treatment with a culture yeast, otherwise the wine will not develop.

DISCUSSION.

Mr. CHAPMAN said that in all the earlier statements it was maintained that mannitol was formed in considerable quantities when organic liquids became ropy, and that some distinct connection existed between the two phenomena. Certainly in the case of sugar solutions which had become viscous very appreciable amounts of mannitol were formed, and there appeared to be some close relationship between the bacteria responsible for the two changes. That being so, he would like to ask Dr. Schidrowitz whether, so far as he knew, any such connection had been observed in the fermentation of wine; that is to say, whether wines in which mannitol had been formed to a considerable extent also showed, as a rule, any tendency to become

ropy. Dr. Schidrowitz had stated on the authority of a good many Continental observers that high temperatures and lack of acidity were conditions favouring the mannitic fermentation, and there seemed to be very little doubt that the former certainly did constitute a predisposing cause. On the other hand, he (Mr. Chapman) had seen statements to the effect that in the fermentation of wine mannitol was frequently formed in quantity when the fermentation had experienced a serious check. The production of mannitol had also been stated by Peglion to be an anaerobic phenomenon, acetic acid being apparently formed in its place when the organism was grown under aerobic conditions.

Mr. HENRY SYMONS (Totnes) said that he had often found difficulties to arise in the case of cider from a deficiency of acid. The acid was a natural preservative, and a certain proportion appeared to be necessary.

Dr. SCHIDROWITZ thought it was settled that the mannitic bacilli which caused ropiness in sugar solutions were quite distinct from the mannitic bacillus of wine. The point was that the latter did not produce ropiness in wine. It was different from Laborde's bacillus; and from what could be gathered from the literature on the subject of Happ's bacillus, he had come to the conclusion that they were entirely different. He had never observed anything approaching ropiness in wine as the result of the action of the mannitic bacillus. He thought that the mannitic bacillus was not a facultative anaerobe, but an anaerobe proper, and that when surface action occurred it must be due to an entirely different bacillus.

ADDENDUM.

ANALYST, xxvi., p. 264.—The results in Mr. Richmond's paper are expressed in parts per 100,000.

REPORT OF THE CONJOINT COMMITTEE ON THE DETECTION AND APPROXIMATE ESTIMATION OF MINUTE QUANTITIES OF ARSENIC IN BEER, BREWING MATERIALS, FOOD-STUFFS AND FUELS.

THE joint committee of the Society of Chemical Industry, and of the Society of Public Analysts, appointed in March, 1901, and consisting of: Messrs. Otto Hehner (Chairman), Alfred H. Allen, Alfred C. Chapman, C. Estcourt, David Howard, Arthur R. Ling,* Drs. Rudolph Messel, and Leonard T. Thorne, report as follows:

After an examination of various methods, the committee recommend that of Marsh-Berzelius.

MATERIALS REQUIRED.

Hydrochloric Acid.—The purest hydrochloric acid obtainable is very rarely free from arsenic. To the "pure" acid, as purchased for analysis, diluted with distilled water to a specific gravity of 1.10, sufficient bromine is added to colour it strongly

* Mr. Ling also acted as secretary.

yellow (about 5 c.c. per litre) ; sulphurous acid, either gaseous or in aqueous solution, is then added *in excess*, and the mixture is allowed to stand for at least twelve hours. Or hydrobromic acid and sulphurous acid may be used. The acid is then boiled till about one-fifth has evaporated, and the residue can either be used direct, or may be distilled, the whole of the arsenic having volatilized with the first portion.

Sulphuric Acid.—This is more frequently obtainable arsenic-free than hydrochloric acid. If not procurable, to about half a litre of sulphuric acid, "pure for analysis," a few grammes of sodium chloride are added and the mixture distilled from a non-tubulated glass retort, the first portion of about 50 c.c. being rejected. For the purpose of the test to be described, one volume of the distilled acid is diluted with four volumes of water.

Nitric acid can, as a rule, be obtained free from arsenic without much difficulty, the pure redistilled acid being used. This should be tested by evaporating 20 c.c. in a porcelain dish, which should then be washed out with dilute acid, and tested as described in this report.

The purified acids should be prepared as required, and should not be stored for any length of time. If this be unavoidable, however, Jena flasks are to be preferred, since most bottle glass is liable to communicate traces of arsenic.

Zinc.—Arsenic-free zinc is obtainable from chemical dealers. It should be regranulated by melting it and pouring it from some height into cold water.*

Lime.—Caustic lime, even when made from white marble, is not always free from arsenic. A selection must, therefore, be made from various samples. If pure lime is not obtainable magnesia may equally well be used, and can more readily be obtained of sufficient purity.

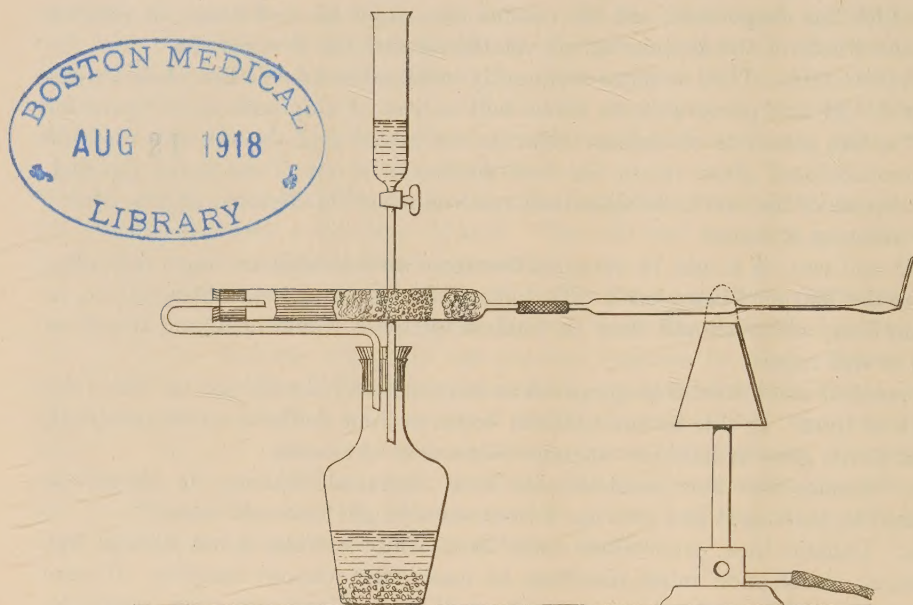
Calcium Chloride.—This salt often contains arsenic, and before being used as a drying agent must be freed from the volatilizable part of the impurity by moistening it with strong hydrochloric acid, fusing, and regranulating.

APPARATUS.

A bottle or flask, holding about 200 c.c. (for frothing materials preferably wider at top than bottom), is fitted with a doubly-bored cork, india-rubber stopper or with a ground-in glass connection, carrying a tapped funnel holding about 50 c.c. and an exit tube. The latter is connected with a drying tube containing, first, a roll of blotting paper soaked in lead acetate solution and dried, or a layer of cotton wool prepared in a similar way, then a wad of cotton-wool, then a layer of granulated calcium chloride, and finally a thick wad of cotton-wool. To this tube is fitted a hard glass tube, drawn out as shown in the figure, and of such external diameter that at the place where the arsenic-mirror is to be expected the tube just passes through a No. 13 Birmingham wire gauge (corresponding with 0.092 inch). The exact size is not material, but all tubes used for standards and tests should be as nearly as practicable of the same diameter. A good Bunsen flame is used to heat the hard glass tube close to the constriction. About one inch of tube, including the shoulder, ought to be red-hot.

* Mr. A. H. Allen holds it to be essential, both for a regular evolution of hydrogen and for the formation of uniformly deposited brown-coloured mirrors, that the zinc should contain a trace of iron.

A piece of moderately fine copper gauze (about one inch square) wrapped round the portion of the tube to be heated assists in insuring an equal distribution of heat. A suitable form of apparatus is shown in the figure.



MODE OF TESTING.

About 20 grammes of zinc are placed in the bottle, and washed with water to clean the surface, as particles of dust may contain arsenic; all parts of the apparatus are connected, and a sufficient quantity of acid (prepared as previously described) allowed to flow from the funnel, so as to cause a fairly brisk evolution of hydrogen. When the hydrogen flame—which, during the heating of the tube should be kept at as uniform a height as possible (about a quarter of an inch)—burns with a round, not pointed tip, all air has been removed from the apparatus. The Bunsen burner should then be placed under the hard glass tube as described, and more acid (10 to 20 c.c. is generally enough) run in as required. With good materials no trace of a mirror is obtained within half an hour. Great care must be taken that when additions of acid are made to the zinc no bubble of air is introduced, since in presence of air the arsenic mirror may become black and unevenly distributed, whilst it is brown when the experiment has been properly conducted.

Should the blank experiment not be satisfactory it must be ascertained by changing the materials methodically whether the fault lies with the acid, zinc, other materials, or with the apparatus.

Preparation of Standard Mirrors.—When a satisfactory blank experiment has been obtained a series of standard mirrors must be prepared under the following conditions:

A hydrochloric acid solution of arsenious oxide, containing in each cubic centi-

metre 0.001 milligramme As_2O_3 , is prepared by diluting a stronger solution with distilled water. Two c.c. of this solution (equal to 0.002 milligramme of arsenious oxide) are introduced into the apparatus, a new tube having been joined to the drying tube. If the zinc is sensitive, a distinct brown mirror is obtained after twenty minutes. It is important to note that some "pure" zinc is, from a cause at present unknown, not sufficiently sensitive; that is to say, the addition of minute quantities of arsenic produces no mirror. The portion of the tube containing the mirror should be sealed off while still filled with hydrogen; in contact with air the mirrors gradually fade. Mirrors are now similarly made with 0.004, 0.006, 0.008, and 0.01 milligramme of arsenious oxide. With a little practice it is easy to obtain the deposits of arsenic neatly and equally distributed. The standard mirrors, properly marked, are mounted on a white card or porcelain slip. It is to be understood that the first stage of every test must be a blank of at least twenty minutes.

Hydrochloric acid is somewhat more sensitive than sulphuric acid—that is to say, it gives rather denser mirrors with minute quantities of arsenic. If for one reason or another sulphuric acid is preferred by the operator, he must make a set of standard mirrors with sulphuric acid, and use these for comparison.

Organic materials, such as beer, yeast, etc., cannot be tested, when sulphuric acid is used, without destruction of the organic matter, whilst, as a rule, they can be directly tested with hydrochloric acid. However, many materials are met with in which it is preferable to destroy the organic matter.

PROCEDURE WITHOUT DESTRUCTION OF ORGANIC MATTER.

The apparatus is started, and a blank experiment allowed to go on for twenty minutes. If no trace of a deposit is obtained, 10 c.c. of the liquid to be tested and about 10 c.c. of hydrochloric acid are put into the funnel, and slowly introduced into the bottle without air-bubbles. Some materials (beers, for example) are apt to froth, hence the necessity for slow introduction. If after about ten minutes no mirror appears, another 10 c.c. of the liquid, with 10 c.c. of hydrochloric acid, are added, and the experiment continued for fifteen to twenty minutes, acid being from time to time added as may appear necessary.

Malt.—Fifty grammes of the malt are placed in a 300 c.c. separator funnel furnished with a stopcock; 50 c.c. of hydrochloric acid, prepared as described, and 50 c.c. of water are warmed to about 50°C ., and poured on the malt. The whole is then allowed to digest for fifteen to twenty minutes, with frequent agitation, and the acid then allowed to run off by the stopcock. About 60 c.c. of the acid liquor is thus obtained, of which every 20 c.c. contains the arsenic from 10 grammes of the malt.

Hops.—Twenty grammes of hops are digested with 100 c.c. of dilute hydrochloric acid (1 volume of the purified acid to 1 volume of water) at about 50°C . for half an hour, 50 c.c. of the strained-off liquid being used for the test.

Sugar and other brewing materials are dissolved in water, 10 c.c. of acid added, and the solution tested direct, operating upon from 10 to 20 grammes of material.

DESTRUCTION OF ORGANIC MATTER.

(a) *Acid Method*.—Ten grammes of the substance are placed in a $3\frac{1}{2}$ -inch porcelain crucible, and covered with pure redistilled nitric acid (about 10 to 15 c.c.). The whole is then heated on a sand-bath until the evolution of brown fumes ceases. Three c.c. of concentrated arsenic-free sulphuric acid are then added, and the heating continued till the mass just begins to char, when a further quantity of 5 c.c. of nitric acid is added. The heating is now continued till all the acid is expelled, leaving in the crucible a black, nearly dry, charred mass. The crucible is about half filled with water and a few c.c. of hydrochloric acid, or of dilute sulphuric acid, run in (according as the one or the other is to be used in the Marsh apparatus), the whole being allowed to extract for about half an hour on a water-bath. It is then filtered into a porcelain basin, the charred mass washed with hot water, and the filtrate concentrated down to about 30 c.c., which is allowed to cool, and is then ready for the test. It is essential that the mass should be *thoroughly* charred, and that the solution, when filtered, should be colourless.

In the case of *beer*, 10 to 20 c.c. are evaporated to dryness on a water-bath, and the residue oxidized as above stated.

Hops.—10 c.c. of pure nitric acid and 5 c.c. of pure concentrated sulphuric acid are mixed in a $3\frac{1}{2}$ -inch porcelain crucible, and the hops are then added in small portions at a time, each quantity being thoroughly disintegrated by pressure under the acid with a glass rod, a further quantity of 5 c.c. of nitric acid being added when about half the hops have been thus introduced. The crucible with its contents is then cautiously warmed so as to avoid frothing over. When the evolution of dense red fumes ceases the heating is increased, and the acids are evaporated on a sand-bath, and the dry charred mass extracted with dilute acid, filtered, concentrated, and introduced into the Marsh apparatus in the ordinary way. It may be noted that with many English hops of relatively fine texture the addition of the second quantity of nitric acid above recommended is unnecessary.

When, owing to the presence of larger quantities of arsenic, smaller amounts of substance—*e.g.*, 0.5 gramme to 2 grammes—are taken, the quantities of acids recommended above may, of course, be reduced.

(b) *Basic Method*.—The materials are mixed with pure lime or magnesia (1 gramme for 20 c.c. of beer), dried and incinerated. For sugars or other solid materials about half their weight of base is employed. The ash is dissolved in hydrochloric acid, and the solution tested. This method is not recommended for hops.

Of *coal* or other *fuel*, after careful sampling, two portions of 1 gramme each are weighed. One portion is incinerated in a platinum dish in a muffle, and the hydrochloric acid extract of the ash tested for “non-volatile arsenic.” The other is intimately mixed with 1 gramme of lime or magnesia and also incinerated. The hydrochloric acid extract of the latter gives the “total arsenic,” the difference between the two determinations being the “volatile arsenic.” It may in some cases be found that the above-mentioned quantity of fuel gives a mirror too dense to be

measured. When this is the case the hydrochloric acid extract is diluted to a determinate volume and an aliquot portion taken.

Sulphites.—The sulphurous acid must be oxidized by bromine, the excess of the latter being removed by heating.

The committee have convinced themselves that arsenic in both states of oxidation can be detected and estimated by the procedure described.

As an additional precaution a fresh tube should always be substituted for that containing the mirror, and the experiment continued for a further period of fifteen minutes. Should a second mirror be formed, the quantity of arsenic with which it corresponds is to be added to that shown by the first.

It must be understood that the tests are only approximate, and that mirrors corresponding with less than 0.003 milligramme of arsenious oxide in the quantity of materials taken cannot be safely relied upon. When a mirror has been obtained, a duplicate test should always be made to preclude error by accidental contamination.

The proof that the mirrors are arsenical is obtained as follows: The narrow portion of the tube containing the mirror (which should not be denser than that produced by 0.01 milligramme of arsenious oxide) is cut off, the hydrogen replaced by air, and the ends sealed up. The tube, held in the tongs, is then heated by drawing it repeatedly through the flame of a Bunsen lamp until the mirror has disappeared. On cooling, minute crystals of arsenious oxide deposit, the sparkling of which can be seen with the naked eye if the tube be held before a luminous flame, and which can be readily identified under the microscope by their crystalline form.

This test, as recommended, is one of such extreme delicacy, that with quantities of 20 grammes (or 20 c.c.) it will give an indication of the presence of 0.000015 per cent. (or one part in 7,000,000) of arsenious oxide. This would represent with solids $\frac{1}{100000}$ grain per pound, with liquids $\frac{1}{1000}$ grain per gallon. It must be understood that the committee do not suggest any limits for traces of arsenic which may be regarded as negligible; but they desire to express the opinion that limits should officially be fixed by the Royal Commission or otherwise. This could be easily effected by prescribing the amounts of solids and liquids respectively to be taken for the test and the minimum mirror to be recognised.

ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS.

FOODS AND DRUGS ANALYSIS.

Detection of Powdered Cocoanut Shell in Ground Spices. A. L. Winton. (*Amer. Journ. Pharm.*, 1901, lxxiii., 552-555.)—According to the author, the adulteration of spices with powdered cocoanut shell is a very common practice in the United States.

The powdered shell contains the tissue elements of the mesocarp, endocarp, and outer testa, but the stone cells of the endocarp are the principal constituent. These cells can be recognised under the microscope by their porous, brownish-yellow cell-walls, which contain a dark brown substance, changing to reddish-brown on treatment with potassium hydroxide. They differ in one or more of these particulars from the stone cells of pepper, allspice, clove stems, walnut shells, almond shells, Brazil-nut shells, hazel-nut shells, peach stones, and olive stones.

Ferric chloride has no immediate effect upon the colour of the brown cells—a characteristic which distinguishes them from the cells of allspice, which are decolorized by potassium hydroxide and immediately changed to green by ferric chloride.

Spices adulterated with charred cocoanut shell show under the microscope black opaque fragments not bleached by *aqua regia* or nitric acid and potassium chlorate. Chemical analysis is also valuable, as is shown in the following table of results obtained by the author. The crude fibre obtained in the analysis is especially suitable for the microscopic detection of stone cells and other tissues.

	Black Pepper (Average of 14 Analyses).	Cloves (Average of 8 Analyses).	Allspice (Average of 3 Analyses).	Nutmeg (Average of 3 Analyses).	Cocoanut Shell (1 Analysis).
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Water	11.96	7.81	9.78	3.63	7.36
Total ash	4.76	5.92	4.47	2.28	0.54
Ash, soluble in water ...	2.54	3.58	2.47	0.86	0.50
Ash, insoluble in HCl ...	0.47	0.06	0.03	0.00	0.00
Volatile ether extract ...	1.14	19.18	4.05	3.02	0.00
Non-volatile ether extract	8.42	6.49	5.84	36.70	0.25
Alcohol extract	9.62	14.87	11.97	10.77	1.12
Reducing substances by direct inversion calcu- lated as starch	38.62	8.99	18.03	25.56	20.88
Starch by diastase method	34.15	2.74	3.04	23.72	0.73
Crude fibre	13.06	8.10	22.39	2.51	56.19
Total nitrogen	2.26	0.99	0.92	1.08	0.18
Oxygen absorbed by aqueous extract	—	2.33	1.24	—	0.23
Quercitannic acid equiva- lent to oxygen absorbed	—	18.19	9.71	—	1.82

C. A. M.

Sulphites as Food Preservatives. Lebbin and Kallman. (*Zeits. öffentl. Chem.*, 1901, vii., 324; through *Chem. Zeit. Rep.*, 1901, 293.)—From numerous experiments carried out on animals and on human beings, the authors have come to the conclusion that our present notions as to the toxicity of normal sulphites are wholly erroneous. With acid sulphites, however, the action is quite different, for most of them are as corrosive ("aggressiv") as free acids.

F. H. L.

Composition and Analysis of Absinthes. A. Hubert. (*Ann. de Chim. anal.*, 1901, vi., 409-413.)—Commercial absinthe or extract of absinthe is prepared by macerating certain plants in alcohol and distilling the extract, or by the addition of essential oils to the alcohol. The proportion of essential oils varies from 1·5 to 5 grammes per litre, and is such that the addition of an equal volume of water produces a characteristic opalescence.

A common adulteration is to replace the essential oils by various resins. For the estimation of the latter the author recommends the following method: 200 c.c. of the absinthe are distilled in a current of steam until the distillate passes over perfectly clear. The resinous residue is concentrated to a syrup and extracted with chloroform, and the extract evaporated. The residue should not exceed 0·5 gramme per litre.

The distillate is extracted several times with petroleum spirit (25 c.c. each time), the united extracts evaporated in a current of dry carbon dioxide, and the residue of essential oils weighed.

The colour of genuine absinthe, which should consist entirely of chlorophyll, is usually derived solely from one plant (*Artemisia pontica*), with the addition in some cases of hyssop. Inferior absinthes contain more or less colour derived from *artemisia*, but, in addition, other colouring principles such as that of veronica.

For the detection of foreign colouring matters, 20 c.c. of absinthe are shaken with several successive portions (5 c.c.) of chloroform until no more colour is extracted. The extract is evaporated and the residue taken up with distilled water. If the solution is colourless, or has only a faint yellow tint, the absinthe was free from artificial colours.

Three types of absinthes are sold, viz., those prepared with alcohol of 70 per cent., of 60 per cent., and of 50 per cent. strength. The following table gives the composition of different commercial samples:

Absinthes.	I	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.
Specific gravity at 15° C. ...	0·9682	0·9666	0·9246	0·9240	0·9153	0·9353	0·9157					
Alcohol per cent. ...	48·0	67·6	55·0	50·0	44·0	50·0	59·0	49·0	47·0	55·0	65·5	57·0
Extract per litre ...	1·56	1·72	0·36	1·08	0·52	0·50	0·92	0·895	0·902	1·32	1·117	0·97
Reducing substances ...	trace	trace	—	trace								
Acidity ...	0·12	0·288	0·024	0·096	0·048	0·072	0·072	0·08	0·111	0·092	0·054	0·08
Aldehydes ...	0·126	0·155	0·005	0·025	0·091	0·10	0·052					
Furfural ...	0·0006	0·0004	0·0007	0·0002	0·0002	0·0003	0·0002					
Esters ...	0·035	0·071	0·005	0·123	0·070	0·070	0·070					
Essential oils ...	1·506	2·614	2·158	4·250	3·340	1·984	2·700	1·619	1·810	2·340	3·10	1·78

C. A. M.

The Detection of Benzoic Acid and Alkali Benzoates in Food. J. de Brevans. (*Journ. Pharm. Chim.*, 1901, xiv., 438-440.)—The aqueous extract of the substance under examination is filtered, acidified with a few drops of dilute sulphuric acid, and extracted with three successive portions (50 c.c.) of a mixture of equal parts of petroleum spirit and ethylic ether.

The united extracts are filtered and evaporated and the residue tested for saccharin (sweet taste) and salicylic acid. If benzoic acid be present it can be identified by its aromatic odour, irritating vapour on heating, and its crystalline form.

In the absence of salicylic acid or saccharin the aniline blue reaction is characteristic. About 0.5 c.c. of a solution of 0.02 gramme of rosaniline hydrochloride in 100 c.c. of aniline is boiled in a test-tube with a trace of the residue for about twenty minutes. If benzoic acid be present the liquid becomes violet-blue, and on adding a few drops of hydrochloric acid and shaking the tube a deep blue insoluble substance separates.

The colour obtained on adding a neutral solution of ferric chloride to benzoic acid, exactly neutralized with potassium hydroxide, furnishes a confirmatory test.

C. A. M.

Estimation of Alcohol in "Sulphuric" Ether. F. Freyer. (*Zeits. landw. Versuchsw. in Oesterr.*, 1901, iv., 955; through *Chem. Zeit. Rep.*, 1901, 308.)—This is a modification of Adam's process (*ANALYST*, 1899, xxiv., 259). It is first necessary to obtain an approximate idea of the amount of alcohol, or alcohol and water, in the ether to be analysed. Twenty c.c. of the sample are, therefore, agitated in a graduated tube with an equal volume of saturated calcium chloride solution. When the volume of residual ether is read off, the loss represents water and (or) alcohol. As 5 grammes of acetyl chloride, the quantity used in the analysis, are equivalent to 2.95 grammes of alcohol or 1.15 grammes of water, it is necessary that the amount of material weighed out for treatment shall not contain more than 1 gramme of liquid capable of being absorbed by calcium chloride solution; in case this should prove to be wholly water. So calculated, the proper quantity of the ether is weighed out in a 100 c.c. flask, and filled up to the mark with anhydrous ether. Twenty-five c.c. of this liquid are titrated as Adam described, but in standardizing the reagent 25 c.c. of the same pure ether should be present, as acetyl chloride may not be altogether without action upon it. Having made the determination, and knowing from the first experiment the amount of true ether present, the respective quantities of water and alcohol can be ascertained by an equation. If desirable, the treatment with acetyl chloride may be repeated on a larger amount of the sample, the maximum permissible quantity being calculated from the above figures, so as not to exceed the decomposing power of the 5 grammes of acetyl chloride taken. Expressed in another way, 1 gramme of ethyl alcohol is equivalent to 1.7 gramme of acetyl chloride, and 1 gramme of water to 4.33 grammes of the chloride.

F. H. L.

A Characteristic Reaction of Morphine. G. Fleury. (*Ann. de Chim. anal.*, 1901, vi., 417, 418.)—A solution of morphine in dilute sulphuric acid gives a faint rose coloration when shaken for six or eight minutes with a little lead dioxide (puce-coloured oxide), and the filtrate changes to deep brown on the addition of an excess of ammonium hydroxide. This coloration, which is due to the formation of protocathechuic acid, remains unchanged for several hours. Iodic acid can be used instead of lead dioxide, but is less satisfactory, since it yields a white precipitate of ammonium iodate.

C. A. M.

New Pharmaceutical Preparations. C. Kippenberger. (*Chem. Zeit.*, 1901, xxv., 1045.)—This article gives details as to the manufacture and clinical properties of a large number of proprietary drugs, etc.; the following abstract records merely the trade names and the true chemical composition of the substances mentioned:

ANTISEPTICS AND DISINFECTANTS.—*Aniodol* and *aquinol* are bodies of imperfectly known constitution. The former is probably prepared from trioxymethylene, glycerol, and some allyl compound; the latter from formalin, glycerol, a potash soap, and thymol. *Guaiasanol* (cf. ANALYST, 1901, xxvi., 159) is a hydrochloride, and crystallizes in white prisms, melting at 184° C. *Guaiamar* (Endemann) is guaiacol glyceryl ester. Kalle and Co. have introduced *triiodo-m-cresol*, made by the action of iodine upon a strongly alkaline solution of the phenol, and the similar *monoiodothymol* is now patented. Various objections having been made to *cinnamyl-m-cresol*, the same firm has replaced the latter constituent by one of its halogen derivatives. The corresponding “esters” of the chlorine and iodine derivatives of *m-cresol* have proved specially powerful antiseptics. F. Hofmann has patented the *ethyl ester of salicylcarboxylic acid*, to be used in the form of its water-soluble alkali-metal salts. Fehrlin has effected an improvement in the manufacture of *salol*, which he prepares by allowing phosphoryl chloride to act upon phenol sodium carbonate (or a corresponding alkaline-earth salt), followed by distillation in steam. G. Cohn has found that higher compounds can be obtained from *salol* by heating it with higher phenols, and the process is therapeutically useful because it enables monosalicylates of divalent phenols (e.g., *resorcinol*) to be prepared more easily. *Resaldol* (Eichengrün) is a water-soluble acetyl compound obtained by the condensation of chlormethylsalicylic anhydride with *resorcinol*. It is stated to be toxic to bacteria not only in neutral, but also in alkaline menstrua. Eichengrün has also recommended the precisely similar condensation product from thymol. *Argent. thiohydrocarburo-sulphonicum*, or *ichthargan* (ANALYST, *ut sup.*), is a brown amorphous, odourless powder containing 30 per cent. of silver, and soluble in water. Its concentrated solution is precipitated by common salt, also by albumin solution, which in large excess redissolves it. *Petrosulfol* is a substance chemically and physically identical with *ichthyol*. *Chininum lygosinatum*, prepared by the interaction of quinine salts and Fabinyi's sodium lygosinate, is used as an alcoholic solution for rendering dressings antiseptic. Boehringer and Sons have patented a method of making *alloxanphenols* by condensing *alloxan* and phenol in presence of hydrochloric or sulphuric acid, zinc chloride, etc.; these bodies are soluble in water, and free from taste. *Sodium*

biiodosalicylate has been successfully introduced by Froloff as a substitute for iodoform; it is employed alone, or diluted with 50 to 97·5 per cent. of talc. Antiseptic, bactericidal, and air-resisting substances have been produced by combining hexamethylenetetramine, or its compounds, with tetriodopyrrol, or with an aromatic sulphonic acid, or halogen derivatives thereof, or with *p*-phenolsulphonic acid or naphtholsulphonic acid. Compounds of hexamethylenetetramine ethyl iodide with tetriodopyrrol, bromo- and chloro-pyrrol, have also been described. Phenols, such as naphthol combined with anthraquinone, phenanthrenequinone, and their derivatives have been introduced. Three modifications of *ibit* (ANALYST, *ut sup.*) are on the market; in these the second C_6H_2 nucleus is combined with (a) $(OH)_2.COOH$, (b) $O_2.BiI.COOH$, (c) $O_2.BiOH.COOH$ respectively. *Ibit* is claimed to be highly antiseptic, harmless, and capable of being sterilized. *Iodogallate* is *airol*, or *airogen*; *gallate* is *dermatol*; *naphthylate*, *orphenol*; *methylenegallate*, *bismal*; *bromphenylate*, *xeroform*; but according to Duyk these all vary somewhat in composition (*cf.* Squire, 19th edition, 145). *Basol* is a substitute for lysol, and is a preparation of cresol-soap containing 50 per cent. of the phenol; it dissolves in water in all proportions to a clear liquid.

ANTIPYRETICS, ETC.—*Aspirin* is acetylsalicylic acid. Propionyl-, butyryl-, valeryl-, and higher condensation products of salicylic acid are now being proposed. A new benzyl ester of salicylic acid has been patented by the Act. Ges. für Anilin Fabrik., Berlin. It is a colourless and odourless oil, not easily soluble in ether or alcohol, readily hydrolyzed by alcoholic potassium hydroxide. Condensation products of antipyrine and primary aromatic amines (*e.g.*, aniline and *p*-toluidine) have been described. The former gives Knorr's pyrazolin reaction. Monoiodo-antipyrine has been introduced. *Thiopyrin* is thioantipyrine; it forms colourless crystals soluble in water and alcohol. *Eupyrin* (ANALYST, *loc. cit.*) forms pale greenish yellow, quite tasteless needles, having a faint odour of vanilla; it is easily soluble in alcohol, ether, and chloroform, not easily soluble in water; it melts at 87° to 88° C. Of the "*eosolsaure Salze*," the calcium, silver, and quinine compounds are now known. *Bromipin* (Squire, p. 153) has a specific gravity of 1·008 in 10 per cent. solution, of 1·331 in 33·3 per cent. solution, both at 20° C.; *iodipin* is used in 25 per cent. solution.

ANÆSTHETICS AND HYPNOTICS.—*New orthoform*, *m*-amido-*p*-oxybenzoic ester, and ordinary orthoform, *p*-amido-*m*-oxybenzoic ester, are rendered more powerful by being combined with chloral (Kalle and Co.), and the compounds are tasteless. *Chlorosonin* is a compound of chloral hydrate with hydroxylamine. *Nirvanin* is the methyl ester of diethylglycocoll-*p*-amido-*o*-oxybenzoic acid; it is proposed as a substitute for cocaine or orthoform, but its value is uncertain. "Compounds" made by mixing the hydrochloride or sulphate of morphine with borax or some other alkali salt, iodoform, and phenol, have been patented as local (dentists') anæsthetics. For *isomorphine* and *desoxymorphine*, *cf.* *Proc. Chem. Soc.*, 1900, xvi., 143. *Phosphoryl-quinine* (-chinin, Zimmer and Co.) is a tertiary quinine phosphate.

ANTITOXINS, ETC.—*Tuberculosamine tuberculate* and a compound of albumin with tuberculin acid are new preparations. *Antiethylin* is the active principle of a serum from horses treated regularly with alcohol; it is recommended for alcoholism.

Septicidin is an analogous product for swine fever, etc. *Atrabilin* is a pale opalescent fluid derived from a glandula suprarenalis. *Brom-tannin-gelatin* is an American product of obvious composition; it is a grayish-yellow powder devoid of taste and odour, containing about 20 per cent. of Br; it is soluble in caustic alkalis, but almost insoluble in water and dilute acids. *Nucleol* is a pure nuclein obtained from yeast; it is a whitish powder soluble in warm water, but not in alcohol; it combines with freshly precipitated metallic oxides to yield *mercurol* (Hg), *nargol* (Ag), *cuprol* (Cu), and *ferrinol* (Fe). This last contains 6 per cent. of iron; *ferratogen* is similar, but contains only 1 per cent. of Fe.

Avenose is a mixture of oatmeal with soluble acorn-malt extract. *Galactogen* is a readily soluble casein preparation; *roborat* is a food-stuff prepared from corn (*cf.* ANALYST, *ut sup.*). *Usunify* is a labiate root found in the Soudan, and used locally as a food. *Fersan* is a compound of iron, phosphorus, and albumin obtained from ox blood; *roborin* is prepared from ox or calf blood by cold sterilization (*cf.* ANALYST, *ut sup.*).

SUNDRIES.—1. *Inorganic*.—The halogen compounds of arsenic are once again being used in medicine. Dupoux has found the triiodide to be very irregular in composition; sometimes it contains antimony, sometimes elemental arsenic, sometimes free iodine. Goldschmidt has described a method of preparing phosphoric anhydride by burning molten phosphorus on a wick. The burner is kept cool to prevent formation of amorphous phosphorus. Strontium bromide and iodide have been introduced as drugs.

2. *Organic*.—*Menthorol* is a mixture of *p*-chlorophenol and menthol, said to be free from the objectionable secondary action of the former alone. *Epicarnin* is a condensation product of cresotinic acid and β -naphthol. *Gasterin* is a preparation from the stomach-juices of dogs; Linossier has ascribed its utility to the unusual amount of hydrochloric acid and pepsin it contains. Medicinal fatty oils treated with carbon dioxide are now being sold, cod-liver-oil in particular, which is said to be much easier of toleration, as it probably contains instable esters of its fatty acids.

During the past year the fourth edition of the German Pharmacopœia has been published. Among the new preparations in it may be mentioned: A 99.6 to 99.7 per cent. alcohol ("absolute"); an ether for anæsthetic work made from specially pure materials; the hydrobromide of the alkaloid arecoline from areca-nut; *hydrargyrum salicylicum*, the secondary mercuric salicylate; *caffeino-natrium-salicylicum*, or "caffeine double salt," a mixture of caffeine and sodium salicylate; *methyisulfonatum*, diethylsulphomethylethylmethane; *pyrazolonum phenyldimethylicum salicylicum*, *salipyrin*, or antipyrine salicylate; *bismuthum subgallicum*; *barium chlorate*; *hydrastine hydrochloride*; and *gelatina alba*. Among severer methods of examination, chloral hydrate must be tested with sulphuric acid for foreign chlorine substitution products; cocaine hydrochloride for isatropylcocaine; mercury, by complete solubility in nitric acid, for antimony and tin; potassium nitrate for the sodium salt; creosote, by its specific gravity, for medically useless phenols; morphine hydrochloride for narcotine; while the essential oils must be more closely examined for their active constituents.

F. H. L.

ORGANIC ANALYSIS.

Estimation of Alcohols or Phenols. A. Verley and F. Bölsing. (*Ber.*, 1901, xxxiv., 3354.)—Although alcohols or phenols only react slowly with organic acid anhydrides in the cold, presence of pyridine causes the reaction to be rapid and very often quantitative, according to the equation :



An acid "mixture" is prepared of about 120 grammes of acetic anhydride and about 880 grammes of dry pyridine. If this is treated with water, pyridine acetate is formed at once; on adding an alkali it decomposes into alkali-metal acetate and free pyridine, and, as both of these bodies are neutral to phenolphthalein, the excess of acid can be titrated. In a 200 c.c. flask 1 or 2 grammes of the alcohol or phenol to be estimated are weighed, 25 c.c. of the mixture are added, and the whole is warmed for fifteen minutes on the water-bath without a condenser (no volatilization need be feared). After cooling 25 c.c. of water are run in, and the uncombined acid is titrated. Care must of course be taken that the mixture and the standard alkali are both at the same temperature. The process is specially suitable for the examination of essential oils, results obtained on a large number of them being quoted in the original.

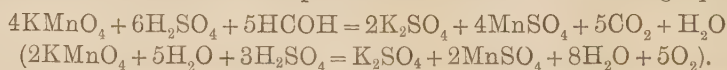
F. H. L.

Detection and Estimation of Methyl Alcohol in Formalin. M. Duyk. (*Ann. de Chim. anal.*, 1901, vi., 407-409.)—The aldehyde is first converted into the non-volatile hexamethylene-tetramine by adding ammonium hydroxide drop by drop to 100 c.c. of the formaldehyde solution, previously diluted with the same quantity of water. After standing for several hours, the slightly alkaline liquid is mixed with a little sodium carbonate and distilled, and the distillate neutralized with sulphuric acid and redistilled. The fractions passing over between 65° and 100° C. are rectified and tested for methyl alcohol by adding red phosphorus and iodine, distilling and collecting the methyl iodide, and calculating its volume into the corresponding quantity of methyl alcohol.

C. A. M.

The Quantitative Estimation of Formaldehyde. L. Vanino and E. Seitter. (*Zeit. anal. Chem.*, 1901, xl., 587-589.)—In Smith's method of oxidizing the formaldehyde in an alkaline solution (*ANALYST*, xxi., 148), the end point of reaction is difficult to recognise.

The authors have found that the oxidation occurs rapidly and sharply by using the permanganate in a strong solution of sulphuric acid in the presence of hydrogen peroxide. The reactions which take place are shown in the following equations :



In making a determination, 35 c.c. of $\frac{N}{5}$ potassium permanganate solution are mixed with a mixture of 30 grammes of sulphuric acid and 50 c.c. of water previously cooled, and 5 c.c. of an approximately 1 per cent. solution of the formaldehyde added drop by drop, with continual agitation. The flask is now closed, and

allowed to stand for ten minutes, an occasional shake being given. The excess of permanganate is then titrated back with an approximately $\frac{N}{10}$ solution of hydrogen peroxide, previously standardized with potassium permanganate.

One c.c. of the permanganate solution corresponds to 0.001723 gramme of formaldehyde.

A sample of formalin thus examined was found to contain, as the mean of three determinations, 37.30 per cent. of formaldehyde, as against 37.08 per cent. by Romijn's iodometric method (ANALYST, xxii., 221).

C. A. M.

Olefines and Naphthenes in Petroleum. L. Balbiano and V. Paolini. (*Chem. Zeit.*, 1901, xxv., 932.)—Since naphthenes absorb bromine, Allen's process for estimating olefines cannot be safely employed in the presence of the former. The authors have accordingly worked out a method based on Denigès' reaction for tertiary alcohols (ANALYST, 1898, xxiii., 216). Their test for olefines is as follows: 10 to 12 c.c. of a cold saturated solution of mercuric acetate are shaken for two or three minutes with 3 or 4 c.c. of petroleum spirit. The tube is corked and set aside; if after twenty-four or thirty-six hours the aqueous liquid is rendered turbid with small white glittering lamellæ, olefines are present.

The test has been applied to three samples of Russian, American, and Italian petroleum with negative results, but a fourth sample, stated definitely to have been American, contained an olefine in the fraction distilling under 100° C., which the authors found to be hexylene.

F. H. L.

The Proportion of Phenols in Essential Oils of Thyme. Jeancard and Satié. (*Bull. Soc. Chim.*, 1901, xxv., 893-895.)—The amount of phenols is usually made the basis of valuation of oil of thyme, and it is commonly accepted that a pure oil should contain from 25 to 30 per cent. The authors, however, have met with specimens of undoubted purity, in which the quantity of phenols varied from 5 to 60 per cent., and have therefore made experiments to determine the cause of this variation.

They find that on distilling the oil the fractions which pass over towards the end contain the bulk of the phenols. They also find that the specific gravity of the oil increases by about 0.0013 to 0.0015 with each increase of 1 per cent. of the proportion of phenols, and that the solubility in alcohol, the surface tension, and the viscosity, also increase with the amount of phenols.

They show that the same plant will yield products richer or poorer in phenols according to the manner in which the distillation is carried out, and conclude that the arbitrary standard of 25 to 30 per cent. might well be considerably raised.

C. A. M.

The Characteristics of Tomato Seed Oil. L. Battaglia. (*Ann. Soc. Chim. Milan*, 1901, 127; through *Ann. de Chim. anal.*, 1901, vi., 437.)—According to the author, tomato oil contains olein, linolin, stearin, myristin, and lecithin (2.3 per cent.). It has the following chemical and physical constants:

Specific gravity at 15° C.	...	...	...	0.922
Refractive index	...	...	...	1.473
Acid value	...	...	...	4.7 c.c. $\frac{N}{10}$ alkali.
Saponification value	...	...	...	190.4
Iodine value (Hübl)	...	...	...	106.9
Hehner value	...	...	...	95.10
Reichert-Meissl value	...	...	...	18.93
Iodine value of fatty acids	...	...	...	112.0

C. A. M.

Candle Nut Oil. J. Lewkowitsch. (*Chem. Revue über d. Fett u. Harz-Ind.*, viii., 156.)—The constants obtained by the author for the oil of candle nuts (from *Aleurites moluccana*) are given below, together with those obtained by De Negri:

	De Negri. (at 15° C.)	Lewkowitsch. (at 15.5° C.)
Specific gravity	0.920 to 0.926	0.92565
Saponification value	184.0 „ 187.4	192.6
Hehner value	—	95.5
Iodine value	136.3 to 139.3	163.7
Refractive constant	(at 15° C.) 76.0 „ 75.5	(at 25° C.) 76.0 (at 20° C.) 78.5
Acetyl value	—	9.8
Hydroxy-acids (insoluble in petroleum ether)	—	0.21 per cent.

By extracting the peeled nuts 58.6 per cent. of oil was obtained. Commercially prepared cakes showed the following composition:

Oil	...	8.80 per cent.	
Moisture	...	10.00 „	
Ash	...	8.28 „	containing { 23.52 per cent. K_2O . 53.04 „ P_2O_5 .
Nitrogenous matter	...	46.16 „	
Cellulose	...	1.47 „	
Starch, sugar, etc. (by difference)	...	25.29 „	
		100.00 „	

A. G. L.

The Detection of Cane Sugar in Vegetable Substances by means of Invertase, and of Glucosides by means of Emulsin. E. Bourquelot. (*Journ. Pharm. Chim.*, 1901, xiv., 481-487.)—The detection of cane sugar by inversion with mineral acids is rendered uncertain by the fact that inulins, starches, and glucosides also undergo inversion.

This difficulty is obviated by the use of invertase, for although it also causes the inversion of raffinose and gentianose, these sugars can be distinguished by their optical properties from cane sugar.

The author obtains a preparation free from enzymes other than invertase by shaking a fresh top-fermentation yeast with 95 per cent. alcohol, allowing the mixture

to stand for thirty minutes, then draining off the liquid, and drying the residue rapidly at 30° C. One gramme of this product is triturated in 100 c.c. of water saturated with thymol and filtered, yielding an active solution which will keep for about a week.

In using it in examining parts of plants, the latter are first treated with boiling alcohol (for fifteen minutes under a reflux condenser) to destroy any soluble enzymes that may be present. The alcoholic extract is evaporated on the water-bath with the addition of some precipitated calcium carbonate, and the residue taken up with water containing thymol and filtered. Ten c.c. of the filtered liquid are then mixed with 10 c.c. of the invertase extract, and a blank experiment made with 10 c.c. of the filtrate, mixed with 10 c.c. of water containing thymol, and left for three days at 15° to 17° C. The amount of cane sugar can then be determined in the usual way by a polarimetrical examination of the liquids before and after inversion.

After the three days the liquid is heated to 100° C. to destroy the invertase, and when cold treated with emulsin in the proportion of 0.05 gramme to 40 c.c., and again left at the ordinary temperature. In the presence of glucosides inverted by emulsin, the formation of reducing sugar will be indicated by the polarimeter and action on Fehling's solution.

C. A. M.

Detection of Indican in Urine. C. Strzyzowski. (*Oesterr. Chem. Zeit.*, 1901. iv., 465.)—Twenty c.c. of the urine are taken for examination. If the specific gravity exceeds 1.015, 10 c.c. of a 10 per cent. solution of normal lead acetate are added; if the specific gravity is 1.015, or less, 5 c.c. of the lead and 5 c.c. of water are used, thus producing 30 c.c. altogether. The mixture is filtered through a dry paper, and 15 c.c. of the clear filtrate are treated first with 1 drop of a 1 per cent. solution of potassium chlorate, then with 5 c.c. of chloroform, and finally with 15 c.c. of pure fuming hydrochloric acid (specific gravity, 1.19), shaking repeatedly. In ten or fifteen minutes the maximum indigo-coloration is attained. Should the separating chloroform be distinctly blue, a second, or even a third, drop of the chlorate solution may be used, shaking immediately; but in general 1 drop (0.5 milligramme of KClO_3) is quite sufficient.

F. H. L.

Estimation of Beta-Hydroxybutyric Acid in Urine. P. Bergell. (*Zeits. physiol. Chem.*, 1901, xxxiii., 310; through *Chem. Zeit. Rep.*, 1901, 299.)—One hundred to 300 c.c. of urine are made faintly alkaline with sodium carbonate, and concentrated on the water-bath to a syrup. The residue is mixed with syrupy phosphoric acid, cooling meanwhile, then with 20 to 30 grammes of powdered anhydrous copper sulphate and 20 or 25 grammes of fine sand, by which a dry powder is obtained, and this is extracted for about an hour in a Soxhlet with ether dried over anhydrous copper sulphate; the extract is filtered, the copper salt washed with dry ether, the solvent distilled off, the residue taken up in 20 c.c. of water, decolorized with animal charcoal, and its lævo-rotatory power determined. According to Magnus-Levy, the specific rotatory power of β -hydroxybutyric acid is -24.12° . Experiments have shown the method to be accurate when tested on urines to which known quantities of the

acid had been added; also (after fermentation) on urines containing 5 per cent. of dextrose. Normal urine never contains any substance soluble in dry ether having a lævo-rotatory power.

F. H. L.

The Detection of Peptone in Urine. Z. Cerny. (*Zeit. anal. Chem.*, 592-595.)

—The author's experiments confirm the statement of Salkowski, who found that in decolorizing urine with lead acetate a certain proportion of any peptone present was precipitated, and when only present in traces could not be detected in the filtrate by the biuret reaction.

He has found a modification of Hofmeister's method the most satisfactory. On treating the urine with tannin and decomposing the precipitate with barium hydroxide, the filtrates are dark and unsuitable for the biuret test. If, however, the liquid be warmed and shaken so as to introduce air, the colouring matters, including urobilin, are oxidized, leaving a colourless solution.

The precipitates obtained from urine by means of phosphotungstic acid, when treated with barium hydroxide, also yield filtrates which, when oxidized in this way, contain only traces of urobilin. Even when that substance was originally present in considerable quantity, the author had no difficulty in applying the biuret test for peptone.

C. A. M.

Estimation of the Covering Power of Pigments. E. Valenta. (*Oesterr. Chem. Zeit.*, 1901, iv., 533.)—This is a process for estimating the covering power of a pigment which does not require the use of a standard, and which gives results that can be expressed in figures. It depends on the following principle, the pigment being ground into oil or varnish in due proportion: If the colour is applied as a uniform film not exceeding a certain thickness to a sheet of black paper which absorbs all incident light, and if under similar conditions it is applied to a sheet of white paper, the amount of light reflected from a unit surface of the printed black paper is less than that reflected from the same area of the printed white paper. The better the covering power of the pigment, the greater will be the quantity of coloured light reflected from the black printed paper in comparison with that reflected from the printed white paper, since the black paper itself reflects no light, and the white paper all; it only remains, therefore, to measure the reflected coloured light. The pigment is ground with the proper proportion of oil or varnish so as to make a printers' ink, and this is applied by the usual lithographic or "letterpress" system of manipulation to the two pieces of paper. In a suitable colorimeter, such as the author has previously described, a piece of pure (unprinted) white paper is put on one side, and a piece of the printed white paper on the other. The liquid-tube before the former is then charged with so much of a solution of the same colour as the pigment that (neglecting mere brightness) both fields of vision appear equally coloured. As a mean of ten observations the depth of solution is found to be W millimetres. The printed white paper is then replaced by the printed black paper; the light which enters the opposite tube is weakened by altering the reflector, until both fields are equally luminous, and the coloured liquid is adjusted as before to give equal depth of colour, the quantity of solution being S. Assuming

that the inks tested all contain the same proportion of pigment and varnish of known viscosity, and that they are applied in films of equal thickness, the ratio $S : W$ expressed as a percentage of W gives a figure for representing the covering power of the pigment in absolute terms. For instance, commercial vermilion gave $W = 54$ millimetres, $S = 21$ millimetres, whence the covering power was 38.9 per cent. Chrome yellow gave 56 millimetres and 35.2 millimetres, or 62.8 per cent. Madder lake ("Krapp") gave 58.6 millimetres and 1.6 millimetres, or 2.7 per cent. Thus the covering powers of chrome yellow, vermilion, and madder lake stand to one another as 62.8 : 38.9 : 2.7.

Valenta finds that the danger of producing films of varying thickness when using the printer's roller, rolling-slab, and block (or lithographic stone) is too small to be of practical significance, but for extremely accurate work the amount of pigment laid on to a unit surface of the papers might be ascertained by the balance, and due allowance made accordingly.

F. H. L.

[It may be observed that Valenta has scarcely laid sufficient stress upon the importance of preparing such inks as he proposes to compare by means of a proper power-driven mill with chilled iron or granite rollers, or a small laboratory model thereof. The old hand muller and stone is a very treacherous instrument except in highly-experienced hands; it is impossible to introduce into the oil or varnish a proper proportion of pigment, and, as the microscope shows, it is impossible to reduce that pigment to a normally fine state of subdivision. Valenta's last remark is perfectly just; a little experience with the letterpress or lithographic roller and the stone or block will show that the amount of ink (hence pigment) applied is regulated automatically, provided the "strength" of the ink is such as to suit the character of the printing press employed. The abstractor has obtained perfectly useful and comparable results, which, however, could not be expressed in figures by merely noting the proportion of vehicle needed to make an ink of proper strength from a given pigment and a standard varnish on a certain mill, and then by examining the character of the impression produced in a hand-press, using a standard "half tone" block very fine in the grain, and having spots of solid colour as well as patches of pure paper. Impressions made in this way can be filed in the dark and kept for reference; they seem to last unchanged for a long time, and they undoubtedly form an efficient means of judging the relative value of any new pigment sample as regards covering power and effect (if any) on the drying power of linseed oil.]

F. H. L.

INORGANIC ANALYSIS.

The Determination of Traces of Antimony in the Presence of Large Quantities of Arsenic. G. Denigès. (*Bull. Soc. Chim.*, 1901, xxv., 995-1000.)—1. *Deposition by means of Tin-platinum Couple.*—The substance under examination (*e.g.*, mirror obtained in Marsh's test) is dissolved in a very small quantity of nitric acid in a round-bottomed platinum crucible, the solution evaporated to dryness on the water-bath, and the residue dissolved in dilute hydrochloric acid (1 : 4), so as to give a solution containing not more than 5 milligrammes per c.c.

A strip of tinfoil, about 4 to 5 centimetres long and 1 centimetre broad, with a pointed end, is then placed in the crucible, with the point resting on the centre of the bottom of the crucible, and its other end resting on the edge.

It is advantageous to concentrate the liquid to a tenth or even a twentieth of a c.c. After ten to thirty minutes, according to the quantity of antimony, the crucible is washed with water, alcohol, and ether, allowed to dry spontaneously, and examined for a stain.

Arsenic acid under the same conditions does not produce any stain when the quantity of arsenic is not more than 5 milligrammes per c.c., provided the time of contact does not exceed thirty minutes. Above that proportion, arsenic gives a stain, though much more slowly than antimony. The author finds that it is thus possible to detect 0.002 milligramme of antimony in the presence of 125 times that quantity of arsenic.

For a quantitative estimation, the stain is compared with that obtained under the same conditions with solutions of antimony in hydrochloric acid containing 2, 4, 8, 12, 16, and 20 thousandths of a milligramme in 0.1 c.c.

Zinc is much less sensitive than tin for this test, and cannot be used in the presence of arsenic.

2. *Formation of Cæsium Antimony Iodide.*—One gramme of potassium iodide and 3 grammes of cæsium chloride are dissolved in 10 c.c. of water, and 1 drop of dilute ammonia (1 : 10) added to the solution. On adding this reagent to a solution of antimony in hydrochloric acid (1 : 4) or sulphuric acid (1 : 10), containing at least 2 milligrammes per c.c., a red precipitate of the double iodide is instantaneously produced, the form of which, in the absence of bismuth, is frequently characteristic of antimony.

It is possible to detect the hexagonal crystals under the microscope in a sulphuric acid solution of antimony not containing more than 0.0001 milligramme in $\frac{1}{100}$ c.c. The reaction is less sensitive in a hydrochloric acid solution.

This quantity of antimony can also be detected in the presence of 500 times the quantity of arsenic, provided that the amount of the latter does not exceed 5 milligrammes in 0.1 c.c. Above that proportion free iodine begins to be liberated.

In examining the stains on the platinum crucible in the first test, or Marsh's mirrors, a drop of nitric acid is added to the substance in a porcelain crucible, and evaporated to dryness. A drop of the cæsium reagent is then placed upon the dry residue, together with an equal volume (0.01 c.c.) of dilute sulphuric acid (1 : 10). After a short time, when antimony is present, a reddish layer is formed, which does not disappear on adding a small drop of sulphurous acid solution, and the intensity of which is proportional to the amount of antimony present.

If the quantity of antimony in the residue is as much as 0.01 milligramme, it may be dissolved in 0.1 c.c. of hydrochloric acid (1 : 4) and a small drop of the solution, mixed with the same quantity of the cæsium reagent on a glass slide, which is examined after two minutes under the microscope.

C. A. M.

A Method for the Quantitative Separation of Nickel and Zinc. Arthur Rosenheim and Ernst Huldshinsky. (*Ber. Deutsch. Chem. Ges.*, xxxiv., 16, 3913.)—A few months ago the authors published a method for the separation of cobalt and nickel based on the solubility in a mixture of ether and amyl alcohol of the compound ammonium cobalt thiocyanate (*Ber.*, xxxiv., 2050). They have now found that a similar method cannot be used to separate zinc from cobalt, since zinc also forms an analogous compound, soluble in the various organic solvents, but that consequently zinc can be separated from nickel in the same way as cobalt. For this purpose, the solution of the chlorides of the two metals is evaporated to dryness, the residue dissolved, together with 12 grammes ammonium thiocyanate, in not more than 50 c.c. water, and the solution repeatedly extracted in a Rothe apparatus with a mixture of 1 volume amyl alcohol and 25 volumes ether. From the solution containing the zinc the ether and alcohol are distilled off, the residue is dissolved in hydrochloric acid, and zinc precipitated with sodium carbonate. The aqueous nickel solution is evaporated to dryness, the residue heated to redness, and nickel estimated electrolytically after dissolving in nitric acid and converting into the double ammonium oxalate.

Analyses by this method of solutions containing known quantities of zinc and nickel gave good results. Some alloys containing copper, nickel, and zinc were also analysed by this method, as well as by separating nickel and zinc with hydrogen sulphide in acetic acid solution, and the results were found to agree well with each other (within 0.2 per cent.), the new method of separation being far more expeditious than the old.

In using the method, it is to be noted that nitric acid must be completely removed before the extraction, as it renders the latter very difficult to carry out. Small quantities of free hydrochloric acid left after evaporation may be neutralized with dilute sodium hydroxide solution. Any iron or cobalt in the alloy will be found with the zinc, and may be recognised by the red or blue colour of the extract. This constitutes a disadvantage of the method, since for technical purposes it is very often only necessary to find the total amount of nickel and cobalt. However, the small quantities of cobalt occurring in these alloys can be readily and accurately separated by the potassium nitrite method after weighing the zinc oxide.

A. G. L.

A Reagent for Ferrous Salts and for Certain Metals of the Zinc and Iron Group. G. Denigès. (*Bull. Soc. Pharm. Bordeaux*, 1901, xli., 161; through *Journ. Pharm. Chim.*, 1901, xiv., 530, 531.)—The author's test is based upon the fact that alloxan, or derivatives containing the alloxan group, give a blue coloration with alkaline solutions of ferrous salts.

The reagent is prepared by mixing 2 grammes of uric acid and 2 c.c. of nitric acid (40° Bé.), adding 2 c.c. of water when the reaction begins to slacken, heating gently until a clear solution is obtained, and diluting it to 100 c.c.

A few c.c. of this reagent mixed with a trace of a solution of a ferrous salt, and rendered alkaline with potassium or sodium hydroxide, gives a blue coloration, which

changes to light yellow on shaking the tube, owing to the conversion of the ferrous into a ferric salt.

The reagent can also be used to identify certain metals in the metallic state. Thus, a fragment of zinc boiled for some time with 2 to 3 c.c. of the liquid gives a yellow coloration. Under the same conditions magnesium gives a deep carmine colour; cadmium a grenadine tint; iron a yellowish-brown tint; nickel (rapidly) and cobalt (more slowly) an orange shade; and manganese (slowly) a deep carmine red colour.

Any confusion between these different colours is prevented by the addition of 1 or 2 drops of sodium hydroxide solution, when the following colorations are produced: Carmine with zinc and cadmium; violet with magnesium; bluish-violet with manganese; blue with iron; Bordeaux red with cobalt; and sepia and then red with nickel.

The author attributes these reactions to the formation of metallic purpurates in the following manner: The hydrogen liberated by the action of the nitric acid on the metals reduces the alloxan to alloxantin, and also converts part of the nitric acid into ammonium nitrate, thus producing the necessary substance for the formation of purpuric acid.

C. A. M.

New Method for the Estimation of Manganese. G. v. Knorre. (*Zeits. f. angew. Chem.*, xiv., 1149.)—In Hampe's method (ANALYST, 1885, 191) there is danger of loss in consequence of the very energetic reaction between 1.4 nitric acid and potassium chlorate. The author therefore oxidizes with ammonium persulphate. (See also ANALYST, xxvi., 221.)

A solution of the ore or alloy is made, containing a little free sulphuric acid and no nitric or hydrochloric acid. An excess of persulphate is added, and the liquid is boiled for four to seven minutes. The precipitated manganese dioxide is filtered off and washed. The filter is placed in a flask, and the precipitate is dissolved by adding an excess of standard ferrous sulphate solution, which is then titrated back with standard permanganate. It is best to standardize the permanganate on a pure manganese compound under the same conditions as occur in the actual determination.

A. M.

Volumetric Estimation Manganese. H. Ramage. (*Chem. News*, lxxxiv., 209.)—For wrought iron, steel, and pig-iron, weigh out 1.1 gramme, add 30 c.c. of dilute nitric acid (about 5N), and boil. Decant the solution, filter off carbonaceous matter if necessary, and to the part undissolved add more nitric acid up to 25 c.c. The free acid is then about 4N. If the sample contains much silicon, care must be taken when boiling not to unduly concentrate the acid, or the silicic acid will separate in a form which blocks up the filter. Cool to about 16° C., oxidize with 2 grammes of "sodium bismuthate," stir for three minutes, and filter through an asbestos filter. Add hydrogen peroxide solution (approximately $\frac{N}{10}$ in N nitric acid) from a burette until the *reddish* colour disappears, then add 1.5 to 3.0 c.c. in excess, and titrate with $\frac{N}{10}$ permanganate. The hydrogen peroxide solution is standardized

against the permanganate in the presence of $\frac{N}{4}$ nitric acid. Each c.c. of $\frac{N}{10}$ hydrogen peroxide solution reduced equals 0.1 per cent. of manganese. A determination can be completed in twelve minutes.

In the case of ferromanganese and spiegels the process given by Reddrop and the author (*Journ. Chem. Soc.*, 1895, 268) need not be modified.

A large excess of hydrogen peroxide must not be used, as a reaction takes place between it and the iron. For each c.c. excess, 0.1 c.c. is reduced immediately. Another small error in the opposite direction is due to reduction of the permanganic acid during and after filtration. This may be avoided by more complete oxidation of the original solution in nitric acid; to effect this it is boiled with 0.5 gramme of bismuthate, cooled, and excess of sulphurous acid is added, then 1.5 gramme of bismuthate, and the determination is completed as described above. A. M.

Volumetric Estimation of Manganese. F. Ibbotson and H. Brearley (*Chem. News*, lxxxiv., 247.)—In the "bismuthate" process (see above Abstract) the reduction of the permanganic acid during and after filtration is ascribed by the authors to the presence of carbon. This makes it essential to complete the oxidation of the carbon in hot solutions—for high carbon steels at any rate. Other substances frequently present in steel-making alloys interfere with the process; some of these are specially considered. The process generally used by the authors is as follows: Dissolve 1.1 gramme of the metal in 35 c.c. of 1.20 nitric acid, and then add bismuthate a little at a time to the somewhat cooled solution until a permanganate colour persists, or on boiling is decomposed to manganic oxide. Clear up the permanganate or the dioxide precipitate with a little hydrogen peroxide, sulphurous acid, or ferrous sulphate free from manganese. Cool the solution, and add about 10 c.c. of water and a considerable excess of bismuthate. Filter, wash with dilute (3 or 4 per cent.) nitric acid, and titrate with decinormal permanganate.

Unlike hydrogen peroxide, the excess of ferrous sulphate does not react with ferric nitrate, and is therefore preferable. It can be safely used in cold nitric acid solutions as above, if the titration is not needlessly delayed. Molybdenum, titanium, and vanadium do not interfere in this modification as they do in Ramage's process. If chromium be present, it is liable to be slowly but completely oxidized by bismuthate to chromic acid, thus giving high results for manganese. The bismuthate should therefore be added, and the solution shaken and filtered quickly. The presence of tungsten introduces no error; but in steels containing much tungsten, and particularly in chrome tungsten steels, the precipitate has a tendency to pass the filter. The joint presence of tungsten and hydrofluoric acid causes the results to be high and very erratic, so the hydrofluoric acid should be driven off with sulphuric acid. A. M.

Volumetric Estimation of Manganese. L. Dufty. (*Chem. News*, lxxxiv., 248.)—A simplification of Reddrop and Ramage's process (see above) for use in works. The nitric acid solution, which has been used for determining the carbon (Eggertz), is transferred to a 25 c.c. stoppered test mixer and made up to a definite

volume. A standard steel of known manganese content is treated in like manner. Equal quantities of bismuthate (0.2 gramme) are added, the contents mixed, allowed to settle (thirty minutes), measured quantities of the clear pink solutions are transferred to stoppered carbon tubes, and the colours compared in the usual manner. (See also ANALYST, this vol., p. 27.)

A. M.

A New Gravimetric Method of Estimating Tellurium. A. Gutbier. (*Berichte*, 1901, xxxiv., 2724-2726.)—The ordinary methods in which the tellurium is precipitated from an acid solution is open to the objection that the element readily undergoes oxidation, and may then dissolve to a considerable extent during the washing. On the other hand, when the precipitation is effected by boiling an alkaline solution with dextrose, the excess of alkali necessary interferes with the determination.

The author's method consists in precipitating the tellurium with hydrazine hydroxide, by which method oxidation of the tellurium does not occur.

In making a determination, a weighed quantity of telluric acid was dissolved in warm water in a dish covered with a glass, and a 10 to 20 per cent. solution of hydrazine hydroxide introduced by means of a pipette through the opening between the spout and cover of the dish, until the liquid became dark blue or black, and on boiling yielded a flocculent precipitate of metallic tellurium. A further quantity of the hydrazine hydroxide was now added in successive small portions until the supernatant liquid no longer became coloured. After each addition the dish was heated until the tellurium had completely settled, leaving a colourless liquid above.

When cold the liquid was filtered through a paper filter previously dried at 105° C. and weighed, and the precipitate washed with hot water and dried on the filter at 105° C. until constant in weight. Care was taken to do the washing and drying as rapidly as possible, in order to avoid any chance of oxidation.

In test experiments a sample of telluric acid containing theoretically 55.50 per cent. of tellurium gave by this method 55.29 to 55.70 per cent. of tellurium.

C. A. M.

The Determination of Cæsium and Rubidium as Bisulphate, and of Potassium and Sodium as Pyrosulphate. Philip F. Browning. (*Zeits. Anorg. Chem.*, xxix., 141.)—The author finds that cæsium and rubidium salts of volatile acids, when treated with an excess of sulphuric acid and heated at a temperature of 250° to 270° to constant weight, yield the acid salts CsHSO_4 and RbHSO_4 . Cæsium shows a slight tendency to retain a little more sulphuric acid than corresponds with the acid salt, but if this is heated above 300° it loses water as well as sulphuric acid. When sodium and potassium salts are treated in the same way they yield the pyrosulphates $\text{Na}_2\text{S}_2\text{O}_7$ and $\text{K}_2\text{S}_2\text{O}_7$. Lithium salts yield neither the bisulphate nor the pyrosulphate. The results quoted in support of the above statements are fairly satisfactory.

A. G. L.

Methods for Examining the Recovered Soda of Cellulose Factories. G. Lunge and W. Lohöfer. (*Zeits. f. angew. Chem.*, xiv., 1125.)—This product differs from the crude soda obtained by the Leblanc process in that it contains large quantities of sulphide and also, if straw be used as the source of cellulose, considerable quantities of silicate. For regulating the factory processes it is necessary that the following constituents should be estimated: Caustic soda, carbonate, silicate, sulphide, sulphite and sulphate of sodium, and insoluble matter. It is not possible to entirely precipitate the silicate along with the carbonate by the addition of barium chloride; consequently, other methods must be used to distinguish the constituents one from the other. The authors find that in the presence of sodium chloride sodium silicate requires the full theoretical quantity of hydrochloric acid to neutralize it, whether methyl orange or phenolphthalein be used as indicator. The analysis is carried out as follows:

Fifty grammes are dissolved at about 45° C. by shaking with about 500 c.c. of water, free from carbonic acid and air, in a closed litre flask. This is then filled to the mark.

1. *Insoluble matter* is determined as is usually done in crude soda.

2. *Alkalinity*.—Twenty c.c. is titrated with $\frac{N}{5}$ hydrochloric acid, using phenolphthalein as indicator; then methyl orange is added, and the titration is continued. The end-point is sharp.

3. $Na_2S + Na_2SO_3$.—Twenty c.c. are diluted with air-free water to about 200 c.c., acidified with acetic acid, and rapidly titrated with $\frac{N}{10}$ iodine solution, using starch as indicator.

4. Na_2SO_3 .—Alkaline zinc solution is added to 100 c.c. of the solution to precipitate the sulphide. The liquid is poured through a dry filter, 50 c.c. of the filtrate are acidified with acetic acid, and titrated with $\frac{N}{10}$ iodine.

5. Na_2SiO_3 .—Twenty c.c. are evaporated to dryness with hydrochloric acid, and silica is determined in the usual way.

6. Na_2SO_4 is determined by precipitation with barium chloride.

The alkalinity determined with methyl orange gives



whereas the number obtained with phenolphthalein indicates



Twice the difference therefore gives $Na_2CO_3 + Na_2S + Na_2SO_3$. Subtracting (3) from this gives Na_2CO_3 . The difference between (3) and (4) gives Na_2S . All the compounds which go to make up the alkalinity are now known excepting NaOH, which can therefore be calculated by difference. A. M.

The Analysis of Alkali Persulphates. G. Allard. (*Journ. Pharm. Chim.*, 1901, xiv., 506-508.)—A common method of valuing alkali persulphates is based upon the fact that they liberate iodine from potassium iodide and on the titration of this iodine with standard thiosulphate solution.

From the author's experiments, which are given in detail, it appears that

if sulphuric acid be added to the liquid, as advocated by Rapp and by Moreau, the results are considerably too high, whereas in a neutral solution they are accurate. The reaction is complete after thirty minutes, but it is advisable to wait for an hour before titrating.

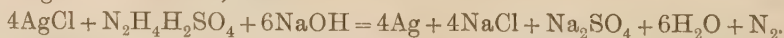
C. A. M.

Quantitative Determination of Fluorine in Fluorides Easily Decomposable by Sulphuric Acid. W. E. Burk. (*Journ. Amer. Chem. Soc.*, xxiii., 825.)—The following is a modification of Carnot's method (*Compt. rend.*, 1892, 114, 750) for the estimation of fluorine. An intimate mixture of 0.2 gramme of the fluoride and 3 grammes recently calcined powdered silica is decomposed at a temperature of 120° to 135° by means of 40 c.c. of sulphuric acid. The evolved gases are led through three U-tubes, plugged at intervals with glass wool, and cooled by means of water, which serve to intercept any sulphuric acid fumes, to the bottom of a narrow cylinder, containing a layer of mercury, and above this 20 c.c. of a 10 per cent. solution of potassium fluoride, which converts the silicon fluoride into potassium fluosilicate.

Immediately before use a current of dry air is drawn through the whole apparatus, which is at the same time warmed. After the introduction of the sample and sulphuric acid, which latter should previously be heated to 165° whilst a current of air is passing through it, the decomposition flask is heated for one and a half hours, the current of air being maintained all the time. The solution and precipitate in the receiving vessel are then transferred to a beaker by means of a pipette, and the vessel rinsed out with small quantities of water. The total volume should not exceed 75 c.c., and a thin coating on the inner wall of the receiving vessel should not be removed, as it is due to addition products of the potassium fluoride and the glass. After adding an equal volume of alcohol, the precipitate is allowed to subside for half an hour, filtered, washed with alcohol, dried at 100°, and weighed. No test analyses are given.

A. G. L.

A Gas Volumetric Method of Determining Chlorides, Hydrochloric Acid, Silver, and Phosphates. E. Riegler. (*Zeit. anal. Chem.*, 1901, xl., 633-638.)—*Chlorides.*—The principle of the method is that on treating silver chloride with hydrazine sulphate and sodium hydroxide, the silver separates in the metallic form whilst nitrogen is liberated; thus



According to this equation, 1 part of nitrogen corresponds to 20.424 parts of silver chloride, but in practice the author found that the corresponding quantity was only 20.2 parts.

In making a determination, the solution of the chloride, which should not yield more than 1 gramme of silver chloride, is acidified with 2 to 3 c.c. of nitric acid, and treated with a 5 per cent. solution of silver nitrate. The resulting precipitate is collected, washed, and transferred to the outer vessel of a Knop-Wagner nitrometer, into which are also introduced about 30 c.c. of water, and about 0.5 gramme of crystallized hydrazine sulphate, whilst 10 c.c. of a 10 per cent. solution of sodium hydroxide are placed in the inner vessel.

The nitrogen is then liberated, measured, with the usual precautions as to temperature, etc., and calculated into its weight in milligrammes. This weight, multiplied by 20.2, gives the corresponding weight of silver chloride, whilst the factor 5 gives the amount of chlorine, and the factor 8.23 the amount of sodium chloride.

A phosphate can be converted into the silver salt, and this into the chloride, which is determined in the above way.

C. A. M.

The Detection of Chromic Acid by means of Hydrogen Peroxide in the Presence of Vanadic Acid. C. Reichard. (*Zeit. anal. Chem.*, 1901, xl., 577-586.)

—One of the sharpest tests for chromic acid and its salts is the well known blue coloration of perchromic acid (Cr_2O_7) which is obtained with hydrogen peroxide.

The author has made a series of experiments which show that the presence of vanadic acid has a strong inhibitive influence on the production of this reaction.

Even when potassium bichromate is added in the proportion of 10 parts to 1 of ammonium vanadate, the restrictive influence of the vanadic acid is still perceptible. By adding sodium arsenate or sodium phosphate, however, the effect of vanadic acid on the perchromic acid reaction is overcome.

As regards other salts, it appears that sodium nitrate, or nitrite, ammonium persulphate, potassium iodate, or uranium nitrate, have no perceptible restrictive influence on the vanadic acid.

The presence of certain acids allied to vanadic acid (molybdic and tungstic acid) were found to exert a similar restrictive influence on the perchromic acid reaction.

C. A. M.

REVIEWS.

FERMENTS AND THEIR ACTIONS. By CARL OPPENHEIMER, M.D., Ph.D. Translated from the German by C. AINSWORTH MITCHELL, B.A., F.I.C. London: Chas. Griffin and Co. Price 7s. 6d. net.

This work contains, within the compass of some 300 pages of reading matter, a résumé of almost all that has been so far published on the subject of enzymes. The matter is therefore presented to the reader in very condensed form, but without any apparent sacrifice of lucidity. The amount of literature which has been perused by the author in the preparation of the book is simply enormous; there is scarcely a page without a reference to some work or periodical, and to some pages as many as a dozen are appended. The book is divided into a general and special part; the former contains a brief historical notice of the enzymes, the definition of these bodies, the influence of external agents upon them, the mode of action of the enzymes, their secretion in plants and animals, and their importance to life. The special part deals with the enzymes individually, dividing them into two great classes—hydrolytic and oxidizing. In this latter class Buchner's zymase is included, the author being of opinion that the oxidation in this case is intramolecular. All through the book Dr. Oppenheimer treats the denominations "ferment" and "enzyme" as synonymous, and as this clashes somewhat with the commonly-accepted notions of the two terms, it may prove somewhat confusing if not borne in mind. An excellent

innovation is the author's proposal to derive the name of the enzyme from that of the body on which it acts; thus the enzyme that converts maltose into glucose, and which has hitherto been called glucase, is now termed maltase, ordinary diastase amylase, etc. The volume concludes with a copious bibliographical index of the literature of the enzymes; it gives references to no less than 1,270 books or papers, and is followed by a general index of subjects, and also one of authors' names. Dr. Oppenheimer deserves our warmest thanks for bringing such an immense mass of information into such readily accessible form; the book cannot fail to be of extreme value to the student as well as to the expert. His views on some of the problems connected with enzymic action will be read with deep interest, although it is painfully evident that finality is a long way from being reached in this recondite subject. The translator, Mr. C. A. Mitchell, is to be congratulated on the excellent manner in which he has performed his by no means light task of translating; he has also interpolated a number of additions to the original text in order to bring the work up to present date. In his preface he calls attention to the recent discovery that some of the enzymes possess a reversible action, and this somewhat contravenes some of the views of the author on the theory of enzymic action.

W. J. S.

AMERICAN HANDY BOOK OF THE BREWING, MALTING, AND AUXILIARY TRADES. By ROBERT WAHL, Ph.D., and MAX HENIUS, Ph.D. Chicago: Wahl and Henius. Price \$10.

This work, as stated in its preface, is designed for a book of ready reference, and makes no pretence to be a text-book on brewing. It consists of 1,266 pages of matter, clearly printed on very thin paper, bound in limp leather, so that it may be carried in the pocket. The authors have been assisted in the production of the book by a number of assistant editors and contributors. The scope of the work is wide indeed, for it not only contains chapters on such subjects as chemistry, brewing materials, micro-organisms, etc., which are ordinarily met with in books on brewing, but such cognate subjects as mensuration, mechanics, machinery, physics, legal information, etc. There is a copious bibliography of works on brewing and kindred subjects, a very useful English-German dictionary of technical terms, and a very full and complete general index. The book is a veritable *multum in parvo*, and certainly well fulfils the object for which it is intended. It is the first standard book that has appeared on American brewing, which, though originally derived from the German system of lager-beer brewing, has developed an individuality peculiar to itself; and the same may be said of American top-fermentation brewing. Though primarily intended for the American brewer, it contains much that is of interest and utility to brewers of other lands.

W. J. S.

SEWAGE AND THE BACTERIAL PURIFICATION OF SEWAGE. By SAMUEL RIDEAL, D.Sc. (LOND.). The Sanitary Publishing Co., Ltd. Price 14s.

The appearance of a second edition of this work within a few months of the first affords a convincing proof that it meets a widespread want. Nor is the reason of its popularity far to seek. When it is considered that treatises on this subject have in general been the work of enthusiasts eager to inform the world of the dis-

covery of the universal remedy for pollution; or of engineers, able and resourceful, but true to their creed of removal rather than depuration; or, lastly, of plodding seekers after information who, with the best intentions, have made confusion worse confounded by heaping in disorder the ill-digested accumulations of tours of inspection, it is not astonishing that a well-considered account, such as that under present notice, of sewage, the changes it undergoes in its natural conversion into inoffensive "water," and the artificial means that have been devised to facilitate and cheapen that conversion, should obtain a world-wide acceptance. The present time is, of course, exceptionally opportune for the appearance of a work of this description. The enormous advances of the past few years, not only in the knowledge of the rationale of sewage purification, but in the technical application of that knowledge, together with the official fixation of established progress by the periodical issue of the reports which may now be expected from the Royal Commission, all tend to render welcome the publication of a scientific statement of the latest views of both theory and practice.

After a preliminary quotation of the findings of the Royal Commission as summarized in their interim report, the author proceeds in the earlier chapters to define sewage, and to describe methods for its chemical and bacterioscopic examination, the preference being given to methods which, if not of the highest degree of accuracy, are capable of easy and rapid application, a matter of prime importance in this particular connection. The various standards of purity of effluents also receive due notice.

Chapter V. introduces the subject proper, the nature of the chemical changes induced in sewage by bacteria, and is followed by a section on Irrigation and Sewage Farms. Chemical precipitation, forming the chief subject of Chapter VII., would seem somewhat out of place in a work devoted to bacterial purification, but follows naturally upon a brief reference to simple subsidence, which is now very generally found to be an economical preliminary to the true bacterial treatment. Chapter VIII., on Sterilization, gives some idea of the task before the Royal Commission in the pursuit of a method of "eliminating or destroying organisms, or at least those giving rise to infectious diseases."

The concluding chapters describe in detail the various appliances that have been devised for assisting the bacteria in their beneficent labours, by providing the conditions under which each group of species can work to the best advantage: and perhaps the most useful feature in the whole book is the clear and emphatic manner in which the absolute necessity for the appropriate alteration of conditions in conformity with the stage of purification at which the sewage has arrived is insisted on. This has long been a matter of course in such industries as depend on the successive utilization of bacteria of different types and habits, and there can be no question that the progress of sewage treatment has been seriously retarded by the failure, except in certain isolated instances, to realize this truth.

A brief account of trade wastes and their influence on bacterial action brings to a close a work which will assuredly take, if it has not already taken, a position as the standard authority on the subject, and which no one responsible for the construction of sewage disposal works can afford to leave unread.

F. W. S.

OBITUARY NOTICE.

THE LATE DR. G. HARRIS MORRIS.

It is with sincere regret that we have to record the death of one of our members, Dr. G. Harris Morris, who passed away on December 30 of last year, at the early age of forty-three years. Born at Bristol, he commenced his scientific career as assistant to Dr. Tilden at Clifton College. He then proceeded to Germany, studied chemistry under Dr. Wislicenus, and graduated as Ph.D. at Würzburg. On his return to England he rejoined Dr. Tilden at Clifton, and when the latter was appointed Professor of Chemistry at Birmingham, accompanied him there, and acted as his demonstrator. In 1883 Dr. Morris was appointed chemist to Messrs. Worthington of Burton, and in conjunction with Mr. (now Dr.) Horace Brown continued those valuable researches on the "Action of Diastase on Starch," which had been commenced some years previously by Brown and Heron. These were followed in 1890 by a masterly investigation (also in conjunction with Brown) on the "Germination of the Grasses," and subsequently by a similar investigation into the physiological chemistry of foliage leaves. More recently, in conjunction with Brown and Millar, a paper of great value and interest was communicated to the Chemical Society—"On the Experimental Methods of the Investigation of Starch Conversion Products," which placed the methods of analysis of these bodies on a more certain foundation. Besides these, Dr. Morris contributed a number of papers to the Chemical Society and to the Institute of Brewing. He was conjoint author with Dr. Moritz of that well-known work "A Text-book of the Science of Brewing." Dr. Morris has for some years past been engaged in private practice as partner with Dr. Moritz. He also held the positions of editor to the *Brewing Trade Review*, and analyst and scientific adviser to the Country Brewers' Society. For some time he was lecturer on bacteriology at the Jenner Institute. Last year the University of Birmingham conferred on Dr. Morris the honorary degree of B.Sc.

INSTITUTE OF CHEMISTRY OF GREAT BRITAIN AND IRELAND.

THE following is a list of the names of the candidates who passed the Intermediate Examination of the Institute of Chemistry held in January, 1902: G. J. Alderton; K. B. Benham; J. L. Garle; H. W. Hill; J. Johnston; A. W. Knapp, B.Sc. (Birm.); S. G. Paine; W. B. Parker; J. B. Pursglove; J. C. Sheldon; H. A. Tempany; and R. Tyler.

FINAL A.I.C. EXAMINATION.—Branch "A" (Mineral Chemistry): A. G. Armstrong; W. W. Lumsden; A. B. Shepherd, B.Sc. (Vict.); and W. F. Sutherst, Ph.D. (Geneva).

Branch "D" (Organic Chemistry): G. Clarke, jun.; E. D. M. Neumann, B.A. (Oxon.), Ph.D. (Göttingen); H. A. D. Neville, B.Sc. (Lond.); G. M. Norman, A.R.C.Sc., B.Sc. (Lond.); W. H. Nuttall; W. H. Peters; and V. W. Theobalds.

Branch "E" (Analysis of Food and Drugs, including an Examination in Therapeutics, Pharmacology, and Microscopy): F. W. F. Arnaud; J. Evans; J. E. Jenkins; W. Partridge; S. O. Richmond; and E. C. Spurge.